MR SULLY UNFOLDS PHYSICS ANSWERS

Acceleration and velocity–time graphs

AQA 4.5.6.1.5
Forces · Paper 2
Foundation & Higher

Name _____ Class _____ Date _____

Acceleration is how quickly velocity changes. Velocity–time graphs show acceleration and distance travelled.

KEY EQUATIONS

$a = \Delta v \div t$
acceleration (m/s²), change in velocity (m/s), time (s)

$v^2 - u^2 = 2as$
final velocity v, initial velocity u (m/s), distance s (m)

On a velocity–time graph: **gradient = acceleration**; **area under the line = distance travelled** (Higher). Free fall near Earth: about 9.8 m/s².

Section A · Recall and calculate

Grade 4–5

1 A car speeds up from 0 to 12 m/s in 4 s. Calculate its acceleration. [2]

$a = 12 \div 4 = 3$ m/s²

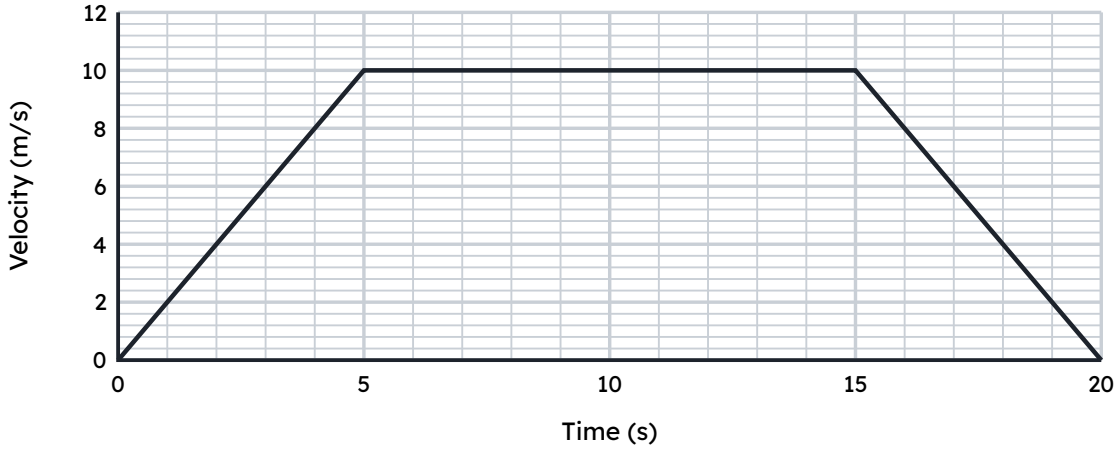
2 What does a negative acceleration mean? [1]

The object is slowing down (decelerating).

Section B · Read the graph

Grade 5–6

3 The velocity–time graph shows a short bus journey.



a Calculate the acceleration in the first 5 s. [2]

$a = 10 \div 5 = 2$ m/s²

b Describe the motion between 5 s and 15 s. [1]

Constant velocity of 10 m/s.

c Calculate the total distance travelled. (Higher) [3]

Area = ½ × 5 × 10 + 10 × 10 + ½ × 5 × 10

= 25 + 100 + 25 = 150 m

Section C · Stretch

Grade 7+

4 A train accelerates uniformly from 4 m/s to 16 m/s over 200 m. Calculate its acceleration. [3]

$v^2 - u^2 = 2as$: $16^2 - 4^2 = 2 \times a \times 200$

$256 - 16 = 240 = 400a$

$a = 0.6$ m/s²

5 A stone is dropped from rest down a well and falls 20 m. Calculate its speed just before it hits the water. Ignore air resistance. ($a = 9.8$ m/s²) [3]

$v^2 - 0 = 2 \times 9.8 \times 20 = 392$

$v = \sqrt{392}$

$v = 19.8$ m/s

Exam-style question

AQA style

6 A cyclist slows down from 8 m/s to rest in 4 s.

a Calculate her deceleration. [2]

$a = (0 - 8) \div 4 = -2$ m/s² (deceleration of 2 m/s²)

b Calculate the distance she travels while slowing down. [2]

Using $v^2 - u^2 = 2as$: $0 - 64 = 2 \times (-2) \times s$

$s = 16$ m

c Sketch the velocity–time graph for this part of the journey. [2]

Straight line (1) sloping down from 8 m/s to 0 at 4 s (1).

Total: _____ / 21

How confident am I?

	Not yet	Nearly	Got it
I can use $a = \Delta v \div t$	☐	☐	☐
I can read acceleration and distance from a velocity–time graph	☐	☐	☐
I can use $v^2 - u^2 = 2as$	☐	☐	☐